



NOAA Fisheries Southwest Region

**NATIVE OYSTER HABITAT RESTORATION
PROGRAM BRIEFING DOCUMENT**

INTRODUCTION

The genus and species that is endemic to the West Coast of North America, including San Francisco Bay, is *Ostreola conchaphila* (formerly *Ostrea lurida*) for which there is not much scientific information. *Ostreola*, commonly called the native oyster, or California oyster in California, has seen reductions in population sizes throughout its range beginning in the mid 1800s and continuing to the present day. In the case of the San Francisco Bay, over harvesting and water quality impacts have reduced what was once the dominant commercial fishery (by weight) resource of the San Francisco Bay to a few scattered remnant populations. In San Francisco during the mid 1800s through the early 1900s, oyster populations were reduced to the point that it was unclear whether any oysters survived. The loss of oyster reef habitat which functions as a cornerstone benthic community, caused a cascading series of impacts to the benthic and pelagic food webs. Without the water quality and substrate stabilizing functions of oyster reefs, eelgrass and other bottom habitats rapidly declined to be replaced by broad expanses of shifting soft bottoms. With the loss of oyster reefs and eelgrass beds, the feeding, sheltering, spawning and nursery functions of these habitats were also lost. This habitat loss had a concomitant and catastrophic impact on those benthic and pelagic species that were formerly dependent upon these habitat types for all, or part, of their life histories.

Current conditions will favor efforts to restore *O. conchaphila* in California embayments. Water quality improvements since the enactment of the Clean Water Act and a shift in commercial harvest to culture of the more marketable *O. gigas* has created an environment favorable to successful recovery. Similar efforts in Washington and Oregon are resulting in rapid and significant recolonization by *O. conchaphila*. Successful recolonization is even occurring in areas such as Coos Bay, where the species had been extirpated for decades. In these areas the successful restoration of native oysters is having appreciable benefits to water quality, substrate stability, and has facilitated the restoration of native eelgrass beds.

HISTORY OF NATIVE OYSTERS IN SAN FRANCISCO BAY

The native California oyster was initially so abundant that their crushed, wind-rowed shells produced a "white glistening beach that extends from San Mateo for a dozen or more miles southward" (Townsend 1893). The accumulated native oyster shells supported a long-lived local cement company. According to Bonnot (1935) San Francisco Bay had been home to native oysters for "ages" (implying centuries). In San Francisco Bay evidence of oyster beds going back 3-4,000 years has been found in shell mounds in the western portion of the South Bay (Point San Bruno, San Mateo Point, and south), along the East Central Bay shore (south of Richmond to Alameda), and up into the Carquinez Straits. Oyster shell middens of the California Indian tribes include large accumulations of oysters even within the Delta where they must have been carried in trade (Skinner 1962; Nichols 1979). In 1912-1913 collections from the Bay by the Albatross (US Fish and Wildlife Service) documented the presence of native oyster shells extending from the Carquinez Straits to the Golden Gate and into the South Bay.

Unfortunately, the flavor of these oysters was disdained by European settlers and led to the first importations of foreign species into the Bay. As part of the massive effort to cash in on the gold rush by giving miners something to buy in the restaurants of San Francisco, the first planting of foreign species in San Francisco Bay may have been the Mexican oyster, *Ostrea chilensis* (Skinner 1962). Shiploads of oysters sailed north but many oysters died en route and the business never prospered. Following the gold rush came the transcontinental railway, which provided a means to transport live animals from the east coast. The first special ore cars to bring animals from the east contained eastern oysters. In the latter half of the 19th century large quantities of eastern oysters were introduced and supported a large landing in the Bay Area. The eastern oyster never successfully reproduced in the Bay, so seed oysters were constantly needed. Transportation of eastern oysters also introduced the predatory eastern oyster drill and the new predator may have played a large role in initial declines of the native oysters (Smith and

Kato 1979). Oyster landings declined from 1915, but importation of Pacific oysters (*C. gigas*) from Japan boosted production after its introduction in 1930. Like the eastern oyster, the Bay Area harvest rested on constant importation of new seed oysters, so World War II brought an end to Pacific oyster culture in the Bay (Skinner 1962).

PROBLEM

The introduction of nonindigenous aquatic species has had disastrous results in California. Moyle and Williams (1990) analyzed the status of native fish species in California and determined that large water projects, in concert with introductions of fish species better able to cope in altered habitats, were largely responsible for the decline of California's native fish fauna. The presence of introduced species was a "very important factor" or the "principal" factor in the status of 49% of those species described as extinct, endangered, or in need of species protection.

The introduction of nonindigenous aquatic species into the San Francisco Bay has resulted in the large scale disruption of established food webs and subsequent loss or decline of native aquatic species at all trophic levels. According to Cohen and Carlton (1995), San Francisco Estuary, with more than 230 introduced species, is the most invaded aquatic ecosystem in North America. Since 1961, the rate of exotic species introductions has been approximately one new species introduction every 14 weeks. Nonindigenous aquatic animals and plants have had a profound impact on the ecology of the Bay in terms of modifying food webs, causing structural changes in Bay habitats, regional extirpation or complete extinction of native species, damage to water-dependent facilities from fouling organisms, and clogging of waterways.

THE ROLE OF NATIVE OYSTERS

Because of the role native oyster reefs play as a cornerstone for benthic habitat, the restoration of native oysters could provide a critical benefit to the Bay ecosystem as a whole and facilitate the recovery of other vital habitats and associated species. The restoration of native oysters could also function as a long term control of non-native, invasive species. Failure to restore native habitats and communities, will perpetuate disturbed ecological conditions that act to encourage colonization and proliferation of introduced species. Therefore, without reversing these conditions, attempts to control non-native species will be, at best, short-term and potentially futile. At worst, such actions could escalate toward more expensive and environmentally damaging (to remaining native species) alternatives, and potentially promote the colonization of even more noxious non-native species.

BENEFITS OF OYSTER RESTORATION

The opportunity to enact restoration of native oysters will provide biological, societal and commercial benefits. Oysters exist as cornerstone species in most of the estuaries and coastal embayments in which they naturally occur. As such, they affect a disproportionate impact on the stability of the estuary or embayment ecosystem by forming a link, a benthic-pelagic coupling, between the phytoplankton in the water column and the bottom-living species that benefit from such plant productivity.

The reduction of oysters reduces filter feeding and the presence of vertical structures in the water column. In turn, when the wind blows, the fetch across open bodies of water changes, and sediment suspension is altered. The next step in the domino chain is that water clarity is reduced, and bottom vegetation, such as eelgrass, declines. The organisms that lived in this vegetation (juvenile crabs, fish and so on) then decline, and the spiral continues. Thus, restoration of oyster communities in their original three dimensional structure is important for many components of the ecosystem.

Similar restoration efforts in Washington, Oregon and the Chesapeake Bay (*C. virginica*) are meeting with striking success in subsequent oyster recruitment, together with increased richness and diversity in native fish populations in the vicinity of reef structures. Such examples are used to increase public awareness of the success of restoration processes and increase long-term participation in such programs by schools, non-profit and civic organizations, and commercial and recreational fishing groups. There is a good foundation to believe that similar efforts will be successful in Tomales Bay and San Francisco Bay.

Literature Cited

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